

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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JUL 30 1993

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)

Replacement of Part 90 by Part 88 to)
Revise the Private Land Mobile Radio)
Services and Modify the Policies)
Governing Them)

PR Docket No. 92-235

**REPLY COMMENTS OF
THE TELECOMMUNICATIONS INDUSTRY ASSOCIATION**

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S U M M A R Y

TIA, like many other industry commenters in this proceeding, supported the goal of increased spectrum efficiency in the private land mobile radio bands but expressed reservations as to the technical and policy basis for some aspects of the Notice's proposals. Specifically, TIA questioned the need to mandate very narrowband (VNB) equipment at this time, encouraged the Commission to allow users to fully amortize their existing equipment, advocated policies allowing technical flexibility, proposed an alternative to the NPRM's reduction of height and power, and recommended revisions to the FCC's proposals for emissions masks and frequency stability. As discussed further in this reply, the 150 comments in this proceeding also provide compelling evidence in support of TIA's recommendations and suggest that aspects of the NPRM proposals should be reconsidered.

First, the comments show universal and broad support for increasing spectrum efficiency in the private land mobile bands. Just as clearly, the comments demonstrate that the proposed very narrowband channelization plan may not be the optimum means for achieving greater spectrum efficiency. Not only is the proposed migration to 5 kHz and 6.25 kHz channelization based on the faulty premise that an interim "screwdriver adjustment" can occur without significant cost, the suggested migration fails to recognize or preserve the value of the existing investment in private land mobile equipment as well as users' need for choice.

Second, many of the comparisons drawn in the comments by proponents of VNB technology perfectly exemplify the need to develop industry-accepted metrics and

measurement techniques when attempting to quantify the efficiency of one technology versus another. Painfully obvious, however, is that spectral efficiency is more than increasing the number of communications links in a band without regard to how those links will be used and will interact with one another in a congested environment.

Third, the comments have expressed significant technical concerns about the practical feasibility of using VNB equipment in heavily populated and congested private

proposed refarming will obsolete a \$25 billion dollar investment in equipment and herald the single largest repacking initiative ever. Depending upon how these factors are balanced, refarming could either be an unqualified success or an unmitigated disaster. TIA believes that adopting its proposed changes--and thereby receiving the support of a majority of the industry--will ensure that refarming lives up to its fullest potential.

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**REPLY COMMENTS OF
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The Mobile and Personal Communications Private Radio Section of the Telecommunications Industry Association ("TIA") hereby submits its reply comments¹ in the above captioned proceeding.² As expected, the opening round comments in this private land mobile "refarming" proceeding displayed a wide range of opinions as to the proper approach for defining this industry's future regulatory framework. One common theme expressed by the vast majority of the comments was that the Commission's proposals to improve spectrum efficiency would bring with them significant cost burdens to the private land mobile user community. While these costs do not necessarily mitigate against any refarming efforts, TIA urges the Commission to ensure that any actions taken in this proceeding minimize the cost, both in financial and operational terms, to private land mobile operators.

¹ These reply comments represent the majority views of the Section. Individual member companies may file their own comments offering additional or alternative recommendations.

² *Notice of Proposed Rule Making*, PR Docket No. 92-235, 7 FCC Rcd 8105 (1992).

I. INTRODUCTION

In TIA's original comments, TIA explained that it shares the Commission's desire to improve efficiency in the private land mobile radio spectrum, but expressed concern that Notice proposals may not continue to satisfy the diverse needs of the private land mobile community within these frequency bands. In particular, TIA recommended that:

- The FCC should provide existing licensees with at least ten years before requiring that they comply with new spectrum efficiency standards.
- It is premature to mandate the future use of 5 kHz and 6.25 kHz channels in the VHF and UHF land mobile bands.
- Contiguous blocks of spectrum should be allocated to specific user groups in order to promote technical flexibility.
- The public interest is served by a common channeling plan for the VHF and UHF bands.
- The structure of power and antenna height limitations must incorporate provisions for users' variety of coverage requirements.
- The Commission should adopt TIA's recommendations for new emission masks and frequency stability requirements.

As discussed below, the suggestions TIA put forth to modify the Notice proposals were supported by a majority of the commenters representing a broad cross-section of interests, including users, frequency coordinators, and manufacturers. In particular, commenters universally agreed that spectrum efficiency is a desirable goal.

discussed below. TIA does not favor any particular technology, and believes strongly

transmitter but not the receiver. Under the circumstances, critical parts of the

_____ did not understand benefits of moving to

regulator, it means creating additional channels to accommodate additional users without affecting the existing radio environment. To the manufacturer, it means installing equipment with a minimum of protective measures to and from the radio environment, *i.e.*, transmitters that meet the emission criteria and receivers that will survive in the new environment. To system designers and frequency coordinators, spectrum efficiency means maximizing the use of the spectrum given a variety of needs and interference protection requirements. None of these views represents the full answer yet each is a desirable goal.

TIA has been attempting to reconcile these competing definitions and concerns. As recognized by NABER,³ the TIA Ad Hoc Committee on Spectrum Efficiency has held meetings to identify the scope of the work and the sources of information in this area. Committee members are presently exchanging papers and are planning a late summer meeting to establish algorithms that hopefully will permit comparisons to be made. To assist the Commission, coordinators, and users, TIA hopes to release a final report detailing its efforts in January of 1994.

Even at this preliminary stage in its efforts, however, it is apparent that spectrum efficiency is more than counting channels. Among other things, spectrum efficiency measures involve equipment specific parameters, system specific parameters, message dynamics and costs. The category of "equipment specific parameters" includes factors such as bandwidth, modulation, adjacent channel protection ratios, and co-channel carrier to interference (C/I) ratios. "System specific parameters" includes

³ See, *e.g.*, Comments of NABER at 11.

antenna height, antenna gain, transmitter power, transmission line features and losses or gains in both transmit and receive mode, desired area of coverage and reliability and whether the system operates as simplex or duplex.⁴ "Message dynamics" considers the message lengths, acceptable waiting periods for various classes of users and whether

to which similar message processing features are incorporated. Finally, "costs

For example, one commenter includes figures and charts that demonstrate methods of comparing the efficiency of various equipment specific parameters,⁵ but fails to compare the C/I ratio requirements of the systems and the adjacent channel protection requirements for reasonably interference free operation between systems.

Consequently, the results fail to consider interference potential inherent in the various modulation schemes as bandwidth is reduced by converting from constant envelope (FM) modulation to partial or fully linear modulation, or various forms of single sideband modulation. In other words, while it is possible to reduce the bandwidth of a

technology without the mandate of any specific technology as the basis for moving forward with the Rulemaking.

Some of the commenting parties, however, recommend that the Commission move directly to a specific technology and offered eloquent statements of support for their own vision and technologies. Notwithstanding the persuasive nature of these comments, these presentations are flawed in that they portend to dictate a single technology as a requirement for all PLMR users and frequency bands. As discussed below, such comments need to be carefully considered with regards to the complex and *real* performance demands placed on the congested PLMR market.

VNB Equipment Availability. Proponents of very narrowband equipment contend that such equipment is ready and available for use today.⁶ While 220 MHz devices are being manufactured by a few companies, there is clearly not, however, a wide proliferation of VNB equipment operating in frequency congested environments.⁷ Not one comment describes established field installations that replicate the heavily congested land mobile spectrum environment in cities like New York City or Los Angeles.

In fact, some manufacturers admit that their equipment is still several years from development. GEC Marconi, for example, states that it will have 6.25 kHz equipment operational in 2-3 years.⁸ Another party, Nippon Telegraph and Telephone,

⁶ See, e.g., Comments of SEA at 1; Comments of Uniden at 2; Comments of Securicor at 2.

⁷ In fact, of the 12 million licensed units operating in the U.S. below 512 MHz (excluding 220 MHz), only 385 licenses, or 0.0032 percent, represent very narrowband operations.

⁸ Comments of GEC Marconi at 2.

states that its Real Zero Single Sideband technology can be available in the U.S. in 2-3 years.

In short, the Commission has little assurances at this date that very narrowband equipment can proliferate in these bands and offer land mobile users the type of quality that they expect and deserve. Of course, the Commission could place its faith in technologists to develop suitable equipment over the next several years. This is a dangerous course of action, however, given the imbedded investment of customer equipment and the hostile environment of land mobile radio.

Co-Channel Interference. In response to the argument that co-channel interference will increase with VNB deployment, commenters argue that co-channel interference can be reduced by combining many channels at the base stations using linear amplifiers. These comments, however, appear to confuse co-channel interference with transmitter generated intermodulation, since use of a combining amplifier has no impact of the receiving co-channel interferences from other transmitters. All factors in system performance must be properly considered--and referenced to a standard⁹--as part of a complete presentation on the matter.¹⁰ The

⁹ VNB proponents have offered the Kenly Radio Technology Laboratory Report on Linear Modulation (the Kenly Report) and the Radiocommunications Agency on Linear Modulation Report (the Agency Report) in support of their claim that VNB technology is technically feasible for deployment in the PLMR bands. Both of these reports, however suffer from defects. The Kenly Report, for example, simulates an interfering linear modulation signal as an FM signal modulated at 400 Hz with a 1.5 kHz deviation. While the signal is at the proper frequency, the signal has no AM component and TIA suspects that the results of the test are far more optimistic than results that would be received with a real interfering signal. In addition, the Kenly Report references a "receive sensitivity" of 2 μ v. The use of a 2 μ v signal requirement would represent a noticeable degradation in system performance for users that are accustomed to FM radio sensitivities in the range of 0.3-0.5 μ v. For a meaningful comparison, the new technology should be compared in range directly with the established base technology (FM) under specified SNR and BER conditions. The Agency Report, for its part, appears flawed in that it tests

(continued...)

FCC must address the total performance and impact of proposed technologies prior to mandating use of any new technology in a major regulatory change such as Refarming.

Intermodulation Interference. The comments observe that Linear Power Amplifiers (PAs) generate fewer intermodulation (IM) products than FM PAs. While this statement is facially correct, it is incomplete since transmitter IM is only a portion of the interference issue. There is no assurance that the transmitter IM problem is manageable until VNB systems are installed and operated in congested environments and the effects of many additional VNB channels and their associated exponential increases in IM products are studied.

Ability to Transmit Data at 9.6 kbit/s. With users increasingly relying on non-voice communications, the ability to send and receive 9.6 kbit/s data in a VNB channel is important. However, VNB proponents' claims to such data rates must be substantiated in both theory and practice. The "ability" must be measured in terms of a specified Bit Error Rate (BER) at some Signal/Noise Ratio (SNR) minimum, or correspondingly, an established threshold SNR specified with a (not to exceed) BER performance quantified. Furthermore, the performance claimed is not even referenced

⁹(...continued)

adjacent channel and intermodulation performance using an *unmodulated* carrier as an interfering signal. Measurements with an unmodulated signal will yield interference results that are significantly more optimistic than will be experienced in the *real* world with *modulated* signals, an observation that holds true on measurements standards/procedures applicable to *any* new technology.

¹⁰ See Comments of EIA Land Mobile Section, Docket No. 15398 (1965). This report concluded that TX Intermodulation, RX intermodulation, impulse noise and adjacent channel interferences all impact radio "range" and quality of performance.

against existing FM land mobile systems. Without quantification and qualification, the claim to be able to transmit 9.6 kbit/s in a VNB channel is meaningless.

Indeed, the conclusion that VNB will support 9.6 kbit/s data rates is also difficult to reconcile with the data in the Radiocommunications Agency on Linear Modulation Report. This indicated that the higher data rate (4.8 kbps) performance was significantly degraded when compared with 4.8 kbps data on a 12.5 kHz FM channel.

Sensitivity to Impulse Noise. VNB proponents claimed a reduced sensitivity to impulse noise and offered measured data in support. TIA notes, however, that while the claimed reduction may be valid in a linear system where the impulse noise is maintained at levels low enough to be within the linear operation of receiver components, this situation can be expected only part of the time in the land mobile environment. Since the comments do not specify a measurement method, higher level impulse performance analysis is absent from the comments. The physics of electronics would generally imply, however, that when the impulse level is strong enough to saturate the receiver amplifiers or filters, the recovery time (from saturation) will dominate, with more narrowband systems taking proportionately longer to recover. In the absence of complete information covering range of real impulse noises encountered in land mobile operations, the FCC cannot make a rational decision on the matter.

Feasibility of Trunking. The VNB comments generally did not address the acquisition time needed to lock onto the reference tone which establishes synchronous detection for trunking on a very narrowband system. Fast acquisition time, however, is a significant factor for many of TIA's member manufacturer's customers. Again, while TIA takes no technology position for or against any technology, this issue is yet another example of the need to consider practical system performance beyond equipment specifications. TIA offers that for a complete comparison of any new technology, the system's complete metrics should also be included as well as comparisons of performance established against the 12 million unit installed base of 25 kHz and 30 kHz equipment. For example, when one considers applications of trunking to the VNB offerings, the metrics of the reference tone detect time, the synchronous detect time, the selective signalling detect time, and the trunking channel access time must all be considered if users can tolerate the cumulative time delay in accessing a channel.

* * * *

While TIA does not wish to create a debate on the merits of any one technology, the issues detailed above perfectly exemplify the need to create industry accepted measurement procedures and metrics *prior* to giving serious consideration to any unproven technology. TIA has created a Technology Compatibility Committee in the Mobile and Personal Communications Section to address this very important task. The Committee will attempt to resolve procedural differences in measurement techniques and develop and issue procedures and practices for measurement of

compatibilities and/or incompatibilities and interferences between the various technologies that are being offered to achieve the Refarming objectives.¹¹

TIA believes that the FCC should carefully investigate how VNB is operating today before uprooting a \$25 billion infrastructure of PLMR equipment. Flexibility was a message that was echoed throughout a large majority of the comments. By adopting very narrowband channels which limit the technology, rather than a particular spectral efficiency, the Commission would eliminate the flexibility needed by the industry as a whole without any assurance that the end result would be improved efficiency.

V. THE FCC SHOULD ADOPT THE TIA RECOMMENDATIONS FOR FREQUENCY STABILITY AND EMISSIONS LIMITATIONS

In its opening comments, the TIA provided the FCC with alternative proposals for frequency stability and emission limitations for both 12.5 kHz and 6.25 kHz transmissions.¹² TIA noted that its proposals are derived from committee work performed by various manufacturers in APCO's Project 25. TIA's proposals are intended to provide a graceful transition from present day equipment to advanced 12.5 kHz digital and analog equipment while also supporting the optional use of 6.25 kHz

¹¹

equipment. Comments submitted by major equipment manufacturers supported the proposals contained in the TIA comments.¹³

TIA is awaiting further industry reaction to its proposals and will provide any necessary documentation and justification after it reviews the reply comments to be filed in this proceeding. At this time, TIA merely reiterates its strong recommendation that the Commission adopt the alternative technical standards for frequency stability and emissions limitations. It is the consensus opinion of the manufacturers participating in the TIA that these recommendations will provide sufficient interference protection to adjacent channel operations in a cost effective manner. More importantly, the standards are technically neutral and would support a variety of land mobile transmission schemes including both analog and digital modulations. TIA believes that such flexibility is imperative if manufacturers are to satisfy the diverse needs of the private land mobile user community.

VI. THE FCC SHOULD ADOPT THE RECOMMENDED HEIGHT/POWER TABLES

In its original comments, TIA recommended regulations governing height and power for private land mobile licensees. Specifically, TIA proposed to allow frequency coordinators more authority to review the technical configuration of newly proposed facilities, while guaranteeing users a minimum "safe harbor" of height and power maximums set forth in a new table. TIA's recommendations were developed in

¹³ See, e.g., Comments of Motorola, Inc.; Comments of E.F. Johnson.

conjunction with LMCC and represent the input of a broad cross-section of the land mobile community. Consequently, as anticipated, there was broad support among the commenters for TIA's recommendations.

TIA's comments, and the comments of a number of other filers, documented the high costs associated with inflexible height and power requirements for private land mobile users. For example, TIA and others noted that rigid adherence to a model of low-power operations would require many users to deploy additional facilities under the new rules to retain their existing coverage, a result that will entail costs in

Under the circumstances, TIA believes that its proposal for a revised format of height/power tables best meets the needs of the land mobile industry. TIA consequently urges the FCC to reconsider its proposal and to instead adopt the TIA recommendation. TIA's plan appropriately encourages the use of lower power facilities, thereby increasing spectrum efficiency, without limiting the flexibility of licensees.

**VII. THE COMMENTS CONTAIN ALMOST UNIVERSAL
OPPOSITION TO THE INNOVATOR BLOCK PROPOSAL**

Second, the proposal creates the entirely uneconomic result of existing private users funding an equipment changeout to free spectrum for commercial licensees. In the Commission's Emerging Technologies proceeding, exactly the opposite result was mandated, and prospective commercial PCS licensees are being required to pay the relocation and equipment upgrade costs to move private licensees into higher spectrum bands. Under the circumstances, the Commission should reconsider the proposal to create innovator blocks within private spectrum.

VIII. THE WORLD IS PROGRESSING TO DIGITAL

During the past three to four years, the PLM industry, users, and manufacturers have made a major investment in technologies, developing plans and equipment that will ensure the orderly migration from analog to digital technology. It is imperative that the Commission, through its rule making, support this marketplace migration to digital systems with a basic 12.5 kHz channel bandwidth plan and technical flexibility rules that would allow wider bandwidth (*e.g.*, 25 kHz) where greater information throughput is required and where channel exclusivity can be established. As discussed below, if the Commission were to establish a very narrowband plan (*e.g.*, 6.25/5 kHz) at this time it would place primary emphasis on analog voice systems and seriously jeopardize the future viability of the U.S. private land mobile industry.

From laptop computers to compact discs, from advanced television to cellular radio, the worldwide electronics industry is migrating to digital technology. Indeed, all major global wireless communications initiatives are digital. In Japan, for example,

cellular initiatives include the Japanese Digital Cellular (PDC) Standard (RCR Std 26); the Japanese Digital Trunking (MCA) Standard (RCR Std 32); the Japanese Private Trunking Standard, currently in committee; and, in fact, MPT insists on digital technology for new spectrum. In Europe, examples include the European Digital Cellular (GSM) Standard; the European Digital Trunking (TETRA) Standard; and the Next Generation of Wireless Standards (UMTS & FPLMTS). In contrast, efforts to establish analog technology standards have and are being rejected globally.

In the United States, the process has already begun. Domestic digital communications initiatives include:

- ***U.S. Digital Cellular and PCS.*** Within the U.S. cellular and personal communications arena, all new system development and standards efforts are focused on some form of digital technology to either provide increased capacity or to reach the goal of personal ubiquitous access to the public switched network.
- ***Next Generation SMRs.*** In the private land mobile 800/900 MHz bands the Commission has initiated rule making to establish an environment that will encourage the marketplace to migrate to next generation digital SMR systems. This conversion will not only provide a much needed increase in communications capacity, but will also support new services including telephone interconnect, data, fax, and imaging on a regional and potentially nationwide basis.
- ***APCO Project 25.*** This Project 25 effort was not only driven by the need for increased communications capacity, interoperability and multiple suppliers but also by the new features and functions that can and will become available from digital systems. Critical to this process was an understanding of the RF environment below 512 MHz where most frequencies are shared in a metropolitan area and where frequency assignments in the heavily used bands (150-174 and 450-470 MHz) are either 15 or 12.5 kHz. Based on these and system consideration, a basic bandwidth of 12.5 kHz was determined to be the optimum choice for migration to digital systems. It provided backward compatibility with today's analog systems based on price and performance trade-offs.

Ensuring that domestic initiatives are supported is critical to the competitiveness of U.S. manufacturers. Electronics is a global industry. Domestic electronics companies cannot sustain themselves in a local market if they fail to compete globally. Leading edge technology and products will be developed in countries and regions which provide the most conducive environment. Trunking technology and SMR's were enabled by the 800 MHz frequency allocations in the U.S. and is now a global industry. An equally conducive environment is required for U.S. electronics and communications companies to take the lead in the conversion from analog to digital land systems.


A recent example of this progression to digital is the leadership shown by the U.S. decision during the advanced television (ATV) standard setting process to take an immediate step to digital television rather than to continue to invest in analog systems as was the case for both Japan and Europe. The significance of this decision has been confirmed by the increasing involvement of the computer and telecommunications industries in the ATV standards setting process. All participants recognize that these efforts may well establish the standards for the next generation interactive multimedia home terminal. Meanwhile, one of the ATV proponents, NHK of Japan, withdrew its proposed narrowband version of that country's analog MUSE system from consideration. NHK took this action after it became clear the Japanese concept had no chance to be adopted in the United States. Japan is now faced with a decision to continue with an analog system in Japan in which it has made a major investment,

while at the same time to initiate efforts in digital ATV for the U.S. and possibly European markets.

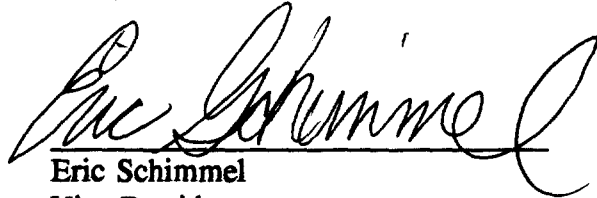
IX. CONCLUSION

As TIA noted in its original comments, the Commission's refarming proceeding is a needed, but ambitious, review of the technical parameters affecting the private land mobile services. The comments fully support proposed regulatory actions improving the quality of service for existing users, while at the same time, providing new spectrum opportunities for manufacturers and future users. However, TIA, and others, urge the Commission to consider the costs associated with refarming heavily populated frequency bands and the practical realities of mandating very narrow bandwidths which focus on specific technologies rather than efficiency.

Respectfully Submitted,



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